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(54) Appliance for the preparation of baby feeds

(57) An appliance for the automated/semi-automated preparation of bulk quantities of baby feeding milk from milk powders or granules, comprises, a container (84) for the particulate foodstuff, a container (87) for water, means (88) for boiling the water, a sensor (91) for detecting the water temperature, a dispensing system (89) for bringing the water and foodstuff together into one container, means responsive to the temperature sensor for activating the dispensing system, upon the cooling of the previously boiled water at an optimum temperature or temperature range for mixing the particulate foodstuff and the water and means (85) for agitating the mixed particulate foodstuff and water to produce the baby feed. Several other embodiments of the dispensing system are also described.

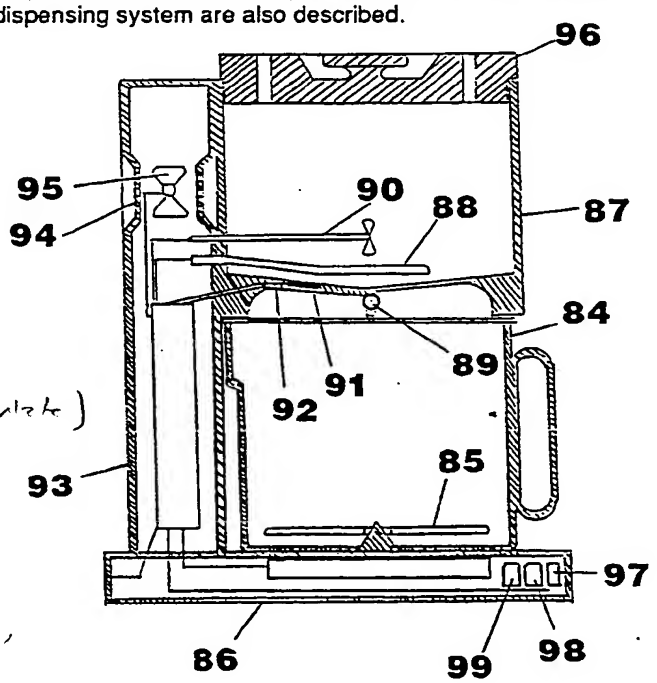

FIG 12

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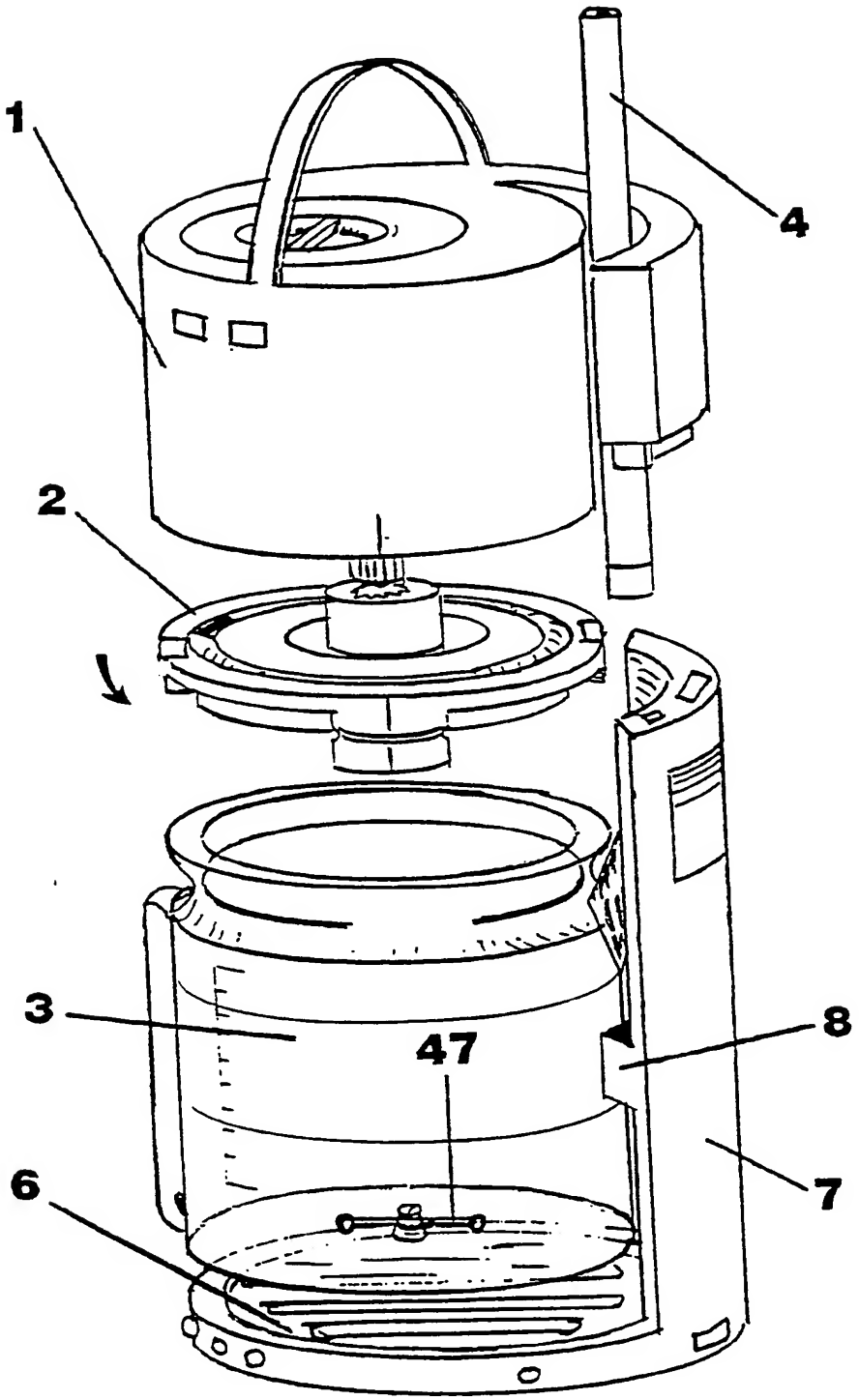


Fig 1

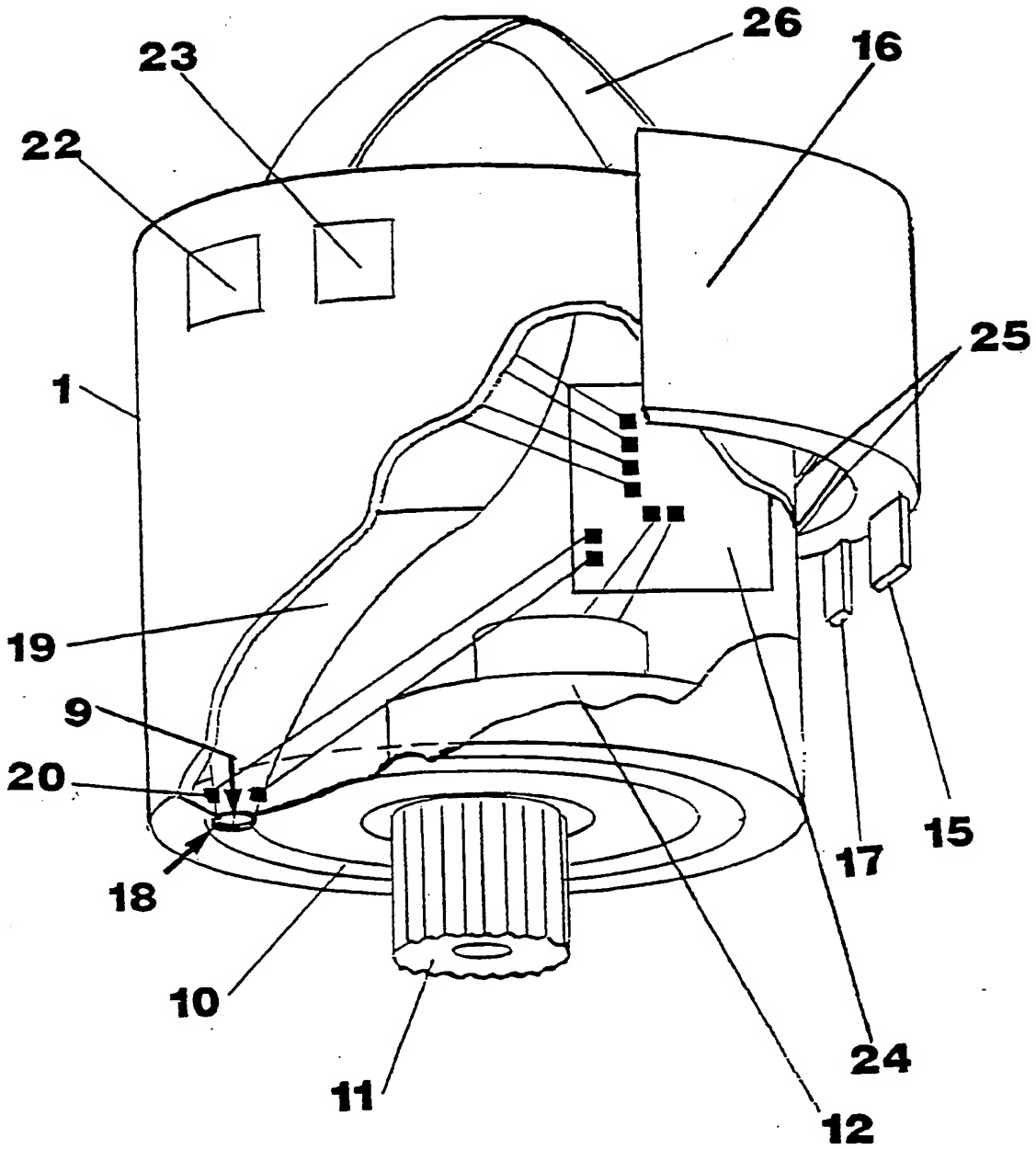


Fig 2

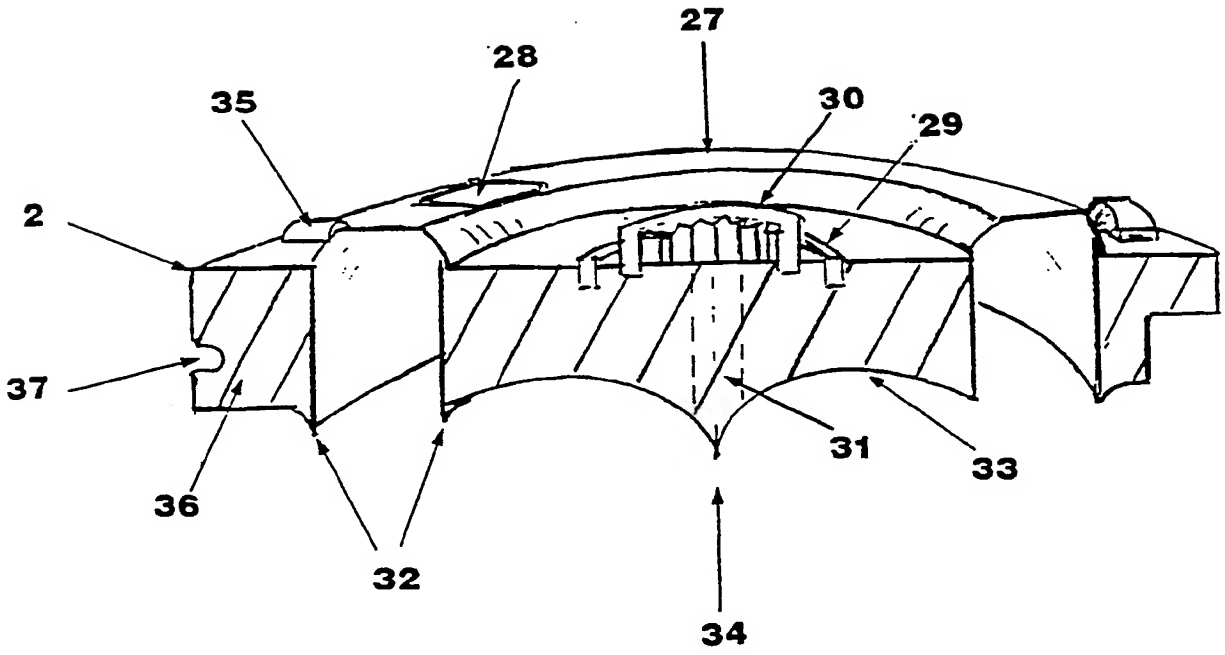


Fig 3

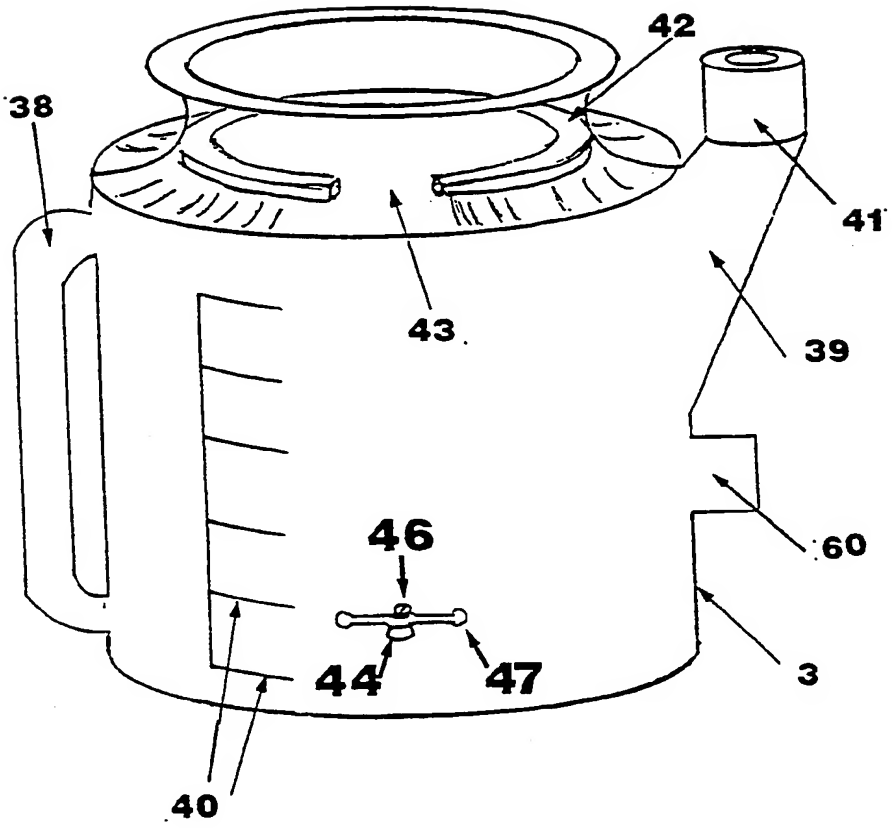


Fig 4

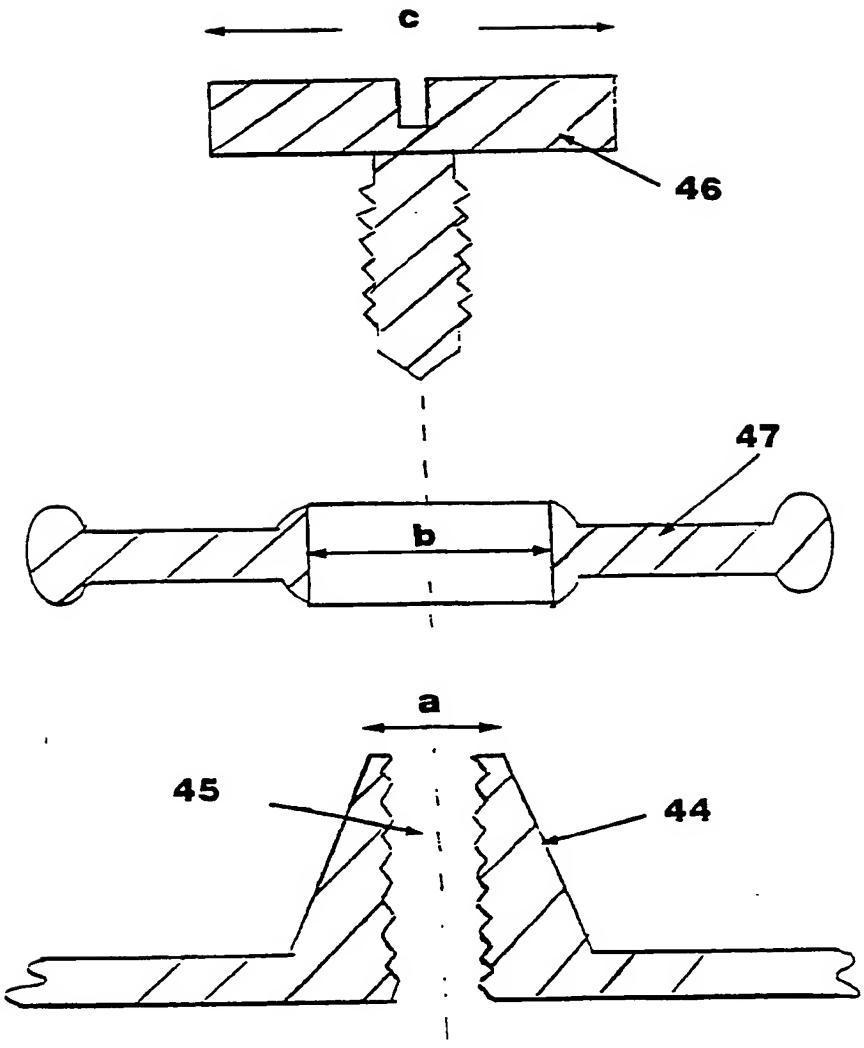


Fig 5

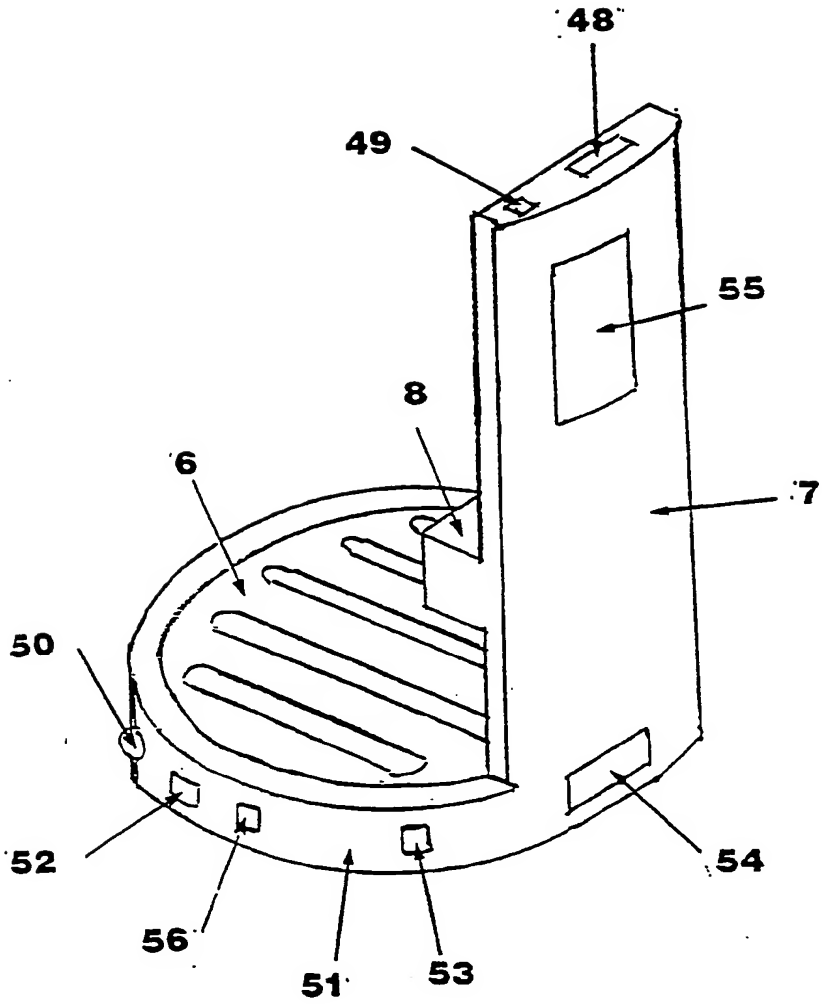


Fig 6

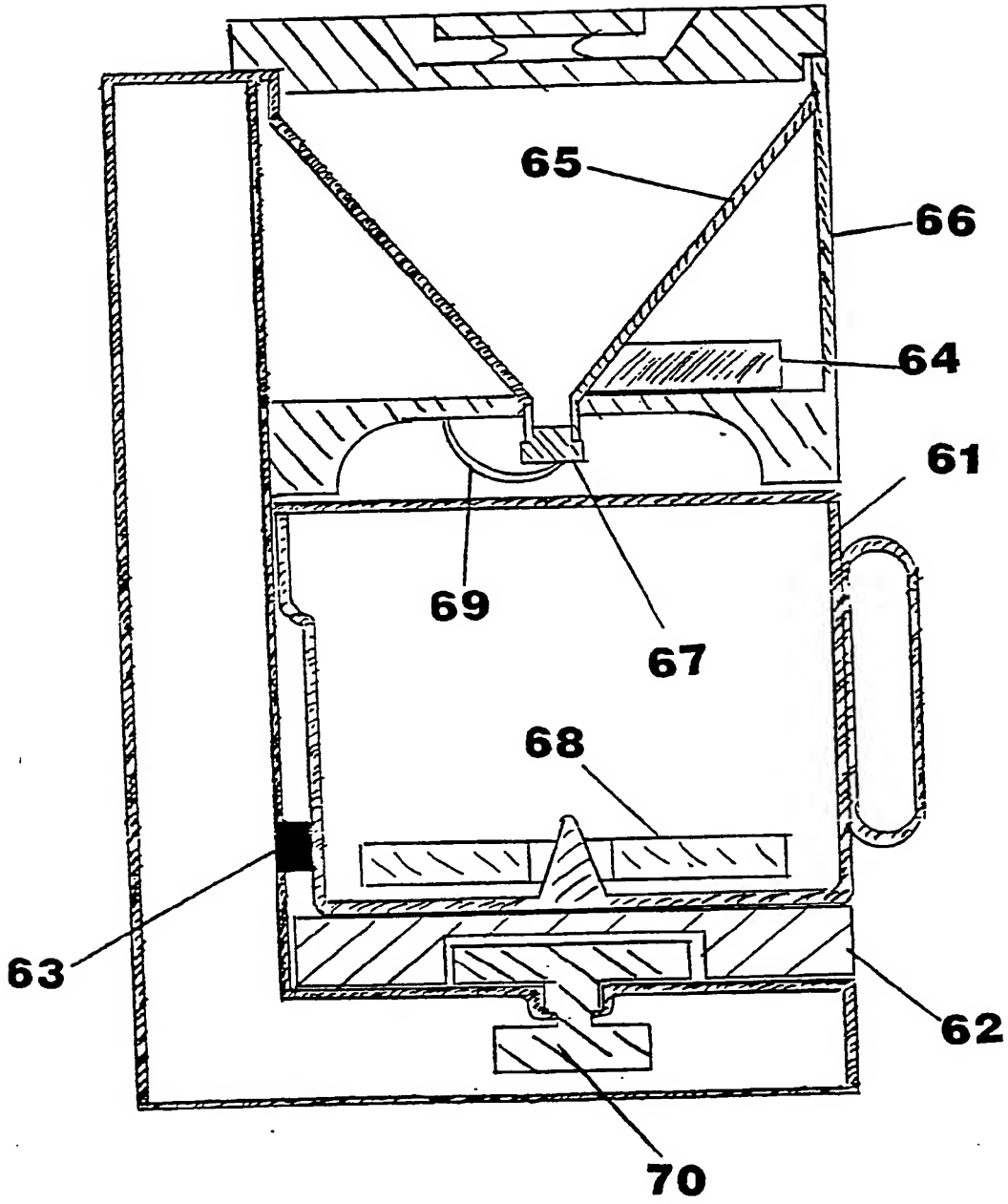


FIG 7

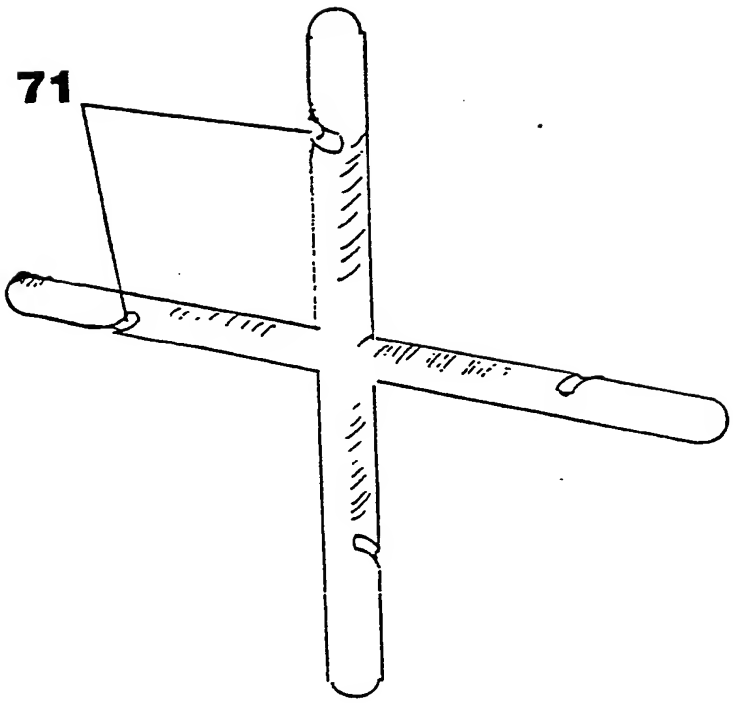


FIG 8

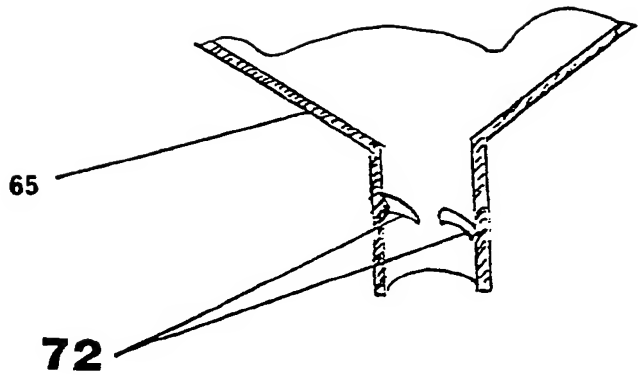


FIG 9

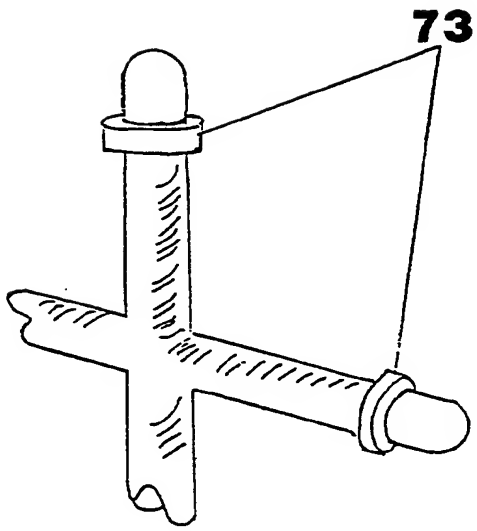


FIG 10

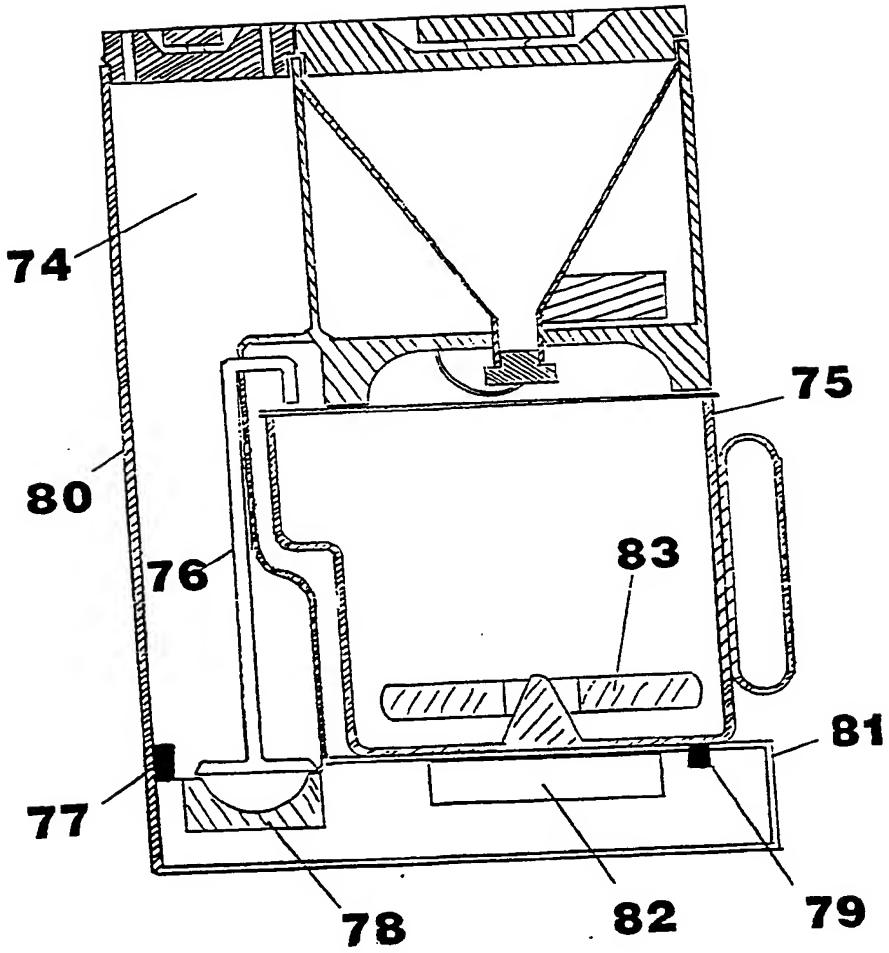


FIG 11

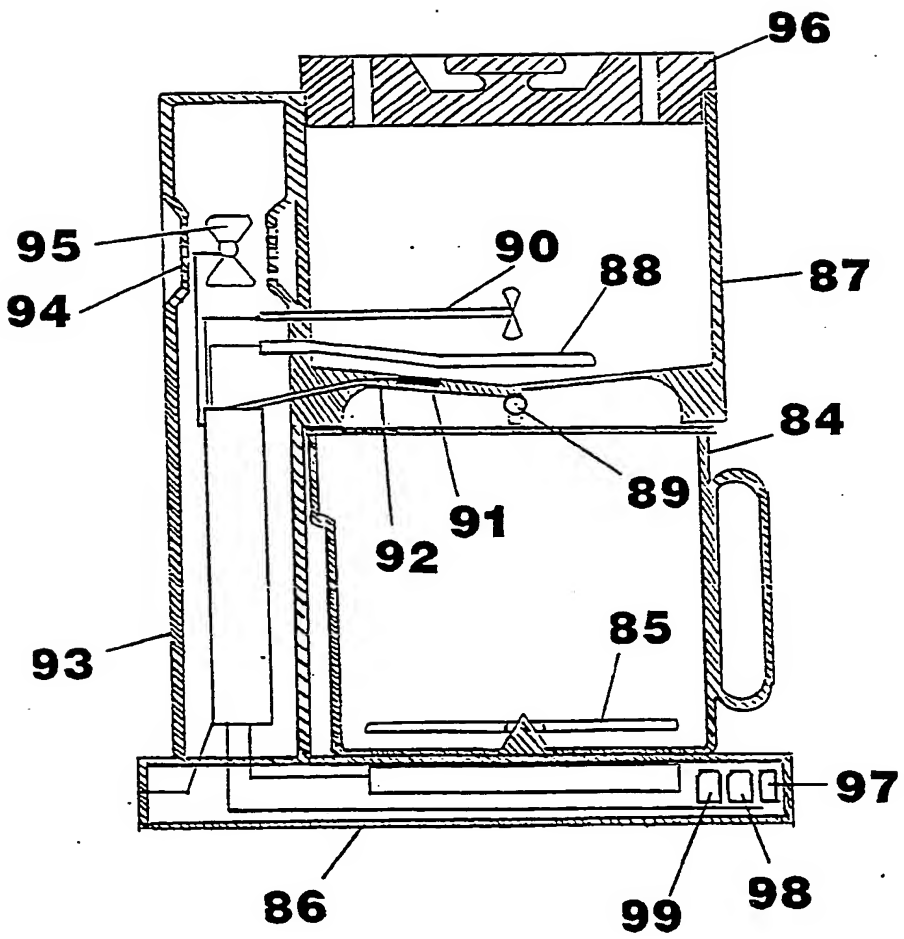


FIG 12

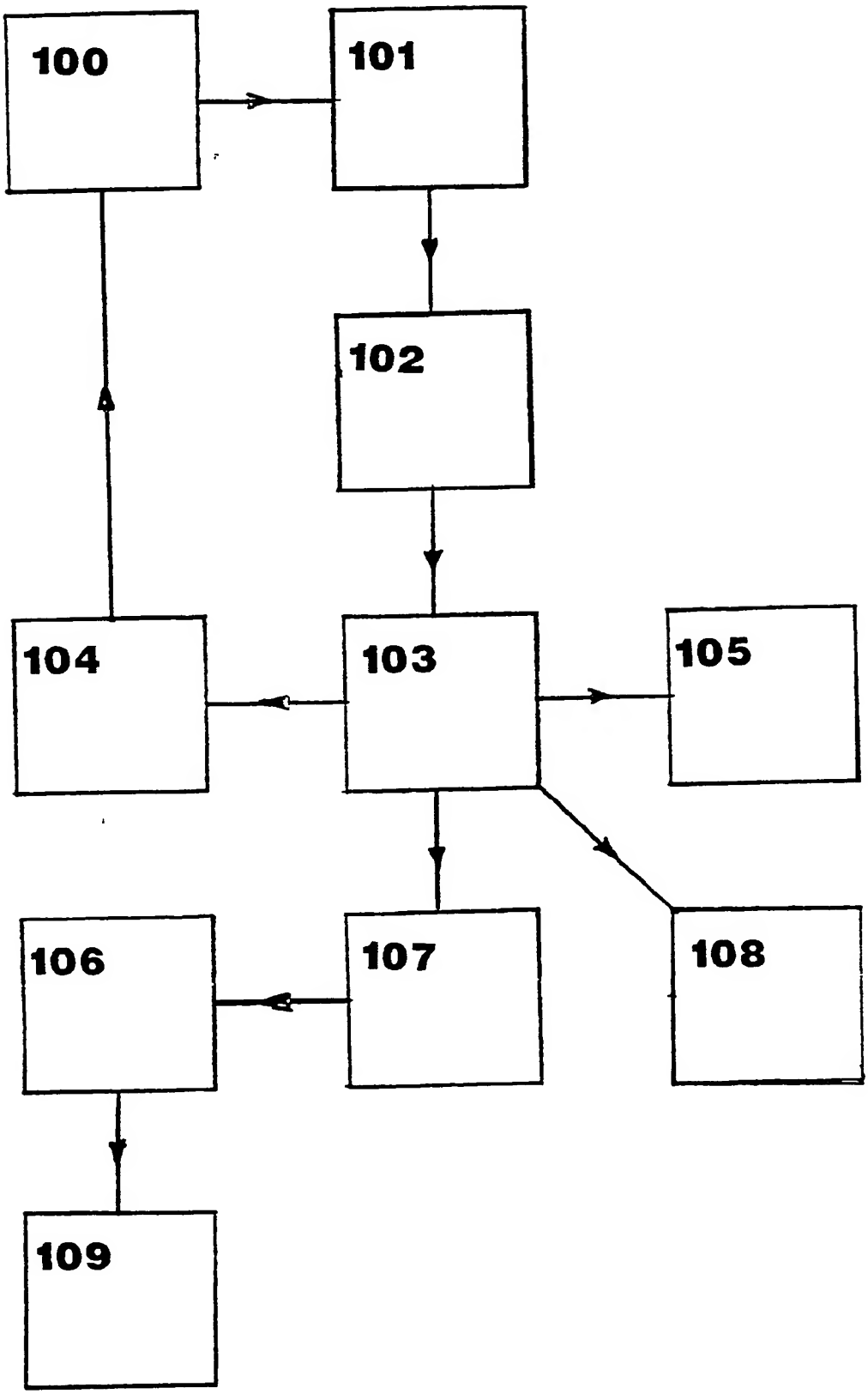


FIG 13

Appliance for the preparation of baby feeds.

This invention relates to an appliance designed for the automated/ semi-automated preparation of bulk quantities of baby feeding milk from milk powders or granules. A bulk quantity is taken to mean any volume greater than that of one conventional feeding bottle (typically 250mls in volume) but is preferably in the range 250mls to 5l for domestic use, or, 5l to 40l for hospital use.

Bottle fed baby milk products are commercially available in particulate (powder or granular) form from a variety of food manufacturers. These products form the basic diet for most babies at some stage of their infancy. Conventionally, particulate baby milk is made up with sterile water in individual bottles by a well established procedure which is described in the instructions accompanying the particulate milk products and is traditionally taught in ante natal clinics. A typical recommended procedure for the preparation of feeding bottles for a single average bottle fed baby for consumption within, say, a 24 hour period, is outlined below:

(1) Specific volumes of boiled water are poured into the sterile feeding bottle.

(2) The individual bottle, now water filled is capped and allowed to cool to the preferred temperature range best suited for optimum mixing of the particulate milk, which is typically around 50°C. This cooling process typically takes one hour.

(3) The cooled bottle is reopened ready for food charging.

(4) A small scoop, provided by the manufacturer is charged with foodstuff and carefully scraped level with a clean or preferably sterile knife. Such a charge would typically be in the order of 4gms weight.

(5) The individual food charge is emptied into a specific previously prepared feeding bottle.

(6) Steps (4) and (5) are repeated, the specified number of times to produce a feed of correct concentration. Repetition may be between 3 and 8 times depending on the requirements and age of the individual baby.

(7) The food charged bottle is recapped with a blank cap and is shaken thoroughly.

(8) The bottle thus prepared to step (7) is again uncapped and a sterile teat replaces the blank.

(9) Steps (1) to (8) are repeated up to 6 times or more depending on the 24 hour requirements of a single baby of a particular size and age. It may be further necessary to

repeat the entire procedure when twins or large numbers of babies are concerned.

The procedure described above suffers from many disadvantages. It is tedious and labour intensive and oftentimes becomes a chore so that the care and attention required in performing this important operation may be sacrificed. It entails much handling of nominally sterilized equipment, such as, bottles, teats, knives, scoops, etc. as well as quantities of boiled water too hot to handle in bottles, particularly of glass construction, for any appreciable time. The latter point encourages the use of tea towels, oven gloves and the like to be used for hand protection so that again the cleanliness required in performing the operation may be sacrificed. Furthermore, on dealing with several feeding bottles simultaneously, for example six (for a single baby), in metering out specific volumes to each individual bottle separately and on counting the requisite scoops of foodstuff, as many as eight per bottle, it is extremely easy to make an error thereby influencing the feed concentration which may ultimately cause stress to the baby receiving the same. Errors are often made by distraction, e.g. by other young children in a family situation.

A still further disadvantage in the recommended procedure, relates to the important assessment of the optimum temperature best suited for mixing the particulate foodstuff. In the procedure described

this assessment is purely subjective, being judged by hand feeling the bottles from time-to-time. This is disadvantageous for several reasons because the consequences of misjudgment may result in further work in remaking the bottles altogether, reheating over cooled water (which is not desirable for sterility reasons) in bottles, or inconvenience/compromised standards in unblocking and resterilising teats which may have become clogged due to improper mixing of the foodstuff as a direct result of the incorrect temperature for mixing. Worst of all misjudgment of optimum conditions for mixing may result in bottles with coagulated milk which may reach the baby and may cause nausea or discomfort to the baby.

A still further disadvantage of the recommended procedure relates to the awkward design of feeding bottles from a preparative standpoint. For ease of handling when feeding, bottles have been designed to be tall with narrow crossections. For feed preparation this shape is awkward in that such bottles are easily knocked over in the multitask, tedious procedure described, thereby losing sterile water and/ or expensive baby milk powder/ granules causing further inconvenience in general cleaning, sterilizing and procedure repetition perhaps when the feedstuff is now in short or shorter supply particularly in the domestic situation.

According to the present invention an appliance has been designed for the safe, accurate and semi-automated production of bulk quantities of baby feed for domestic or hospital situations. The said appliance is a compact labour saving device and is readily cleaned and sterilized. The operator need only charge a water container with the appropriate volume required for a given period, and a food container with a charge of foodstuff appropriate for the aforementioned water volume. Foodstuff may conveniently be measured in one lot with a measuring device similar to that already commonplace for flour measurement in baking for example, except the graduations on the said measure will have been designed for the density of particulate baby foodstuffs. After charging the appliance it is switched on and left to prepare the feed itself. The appliance can indicate when the feed is ready for use or cold storage and is easily taken apart for a simple sterilizing operation. The invention may be explained in more detail below by reference to the drawings in Figures 1-13.

These individually show:

Figure 1: a schematic representation and exploded view of a suitable appliance according to one example of the invention illustrating a means of heating and stirring, a means of metering out particulate foodstuff, a head for food storage, motor housing,

etc., a vessel for liquid containment and a means for reducing water losses due to evaporation.

Figure 2: a schematic representation and cut away view of the head in one example of the appliance, showing the food container, motor and electronics compartment(s).

Figure 3: a perspective representation of the lid for the liquid container, that also serves the purpose of dispensing the foodstuff in one example of the appliance.

Figure 4: a schematic representation of a container ultimately to hold feed and suited to the invention.

Figure 5: a schematic and crossectional more detailed representation of the center post in the said container which serves to provide a location for the stirring mechanism.

Figure 6: a perspective representation of the base and stand of one example of the appliance which houses electronics or electrical connections, heating means and stirring and cooling mechanism(s).

Figure 7: a crossectional representation of an embodiment of an appliance suitable for the preparation of baby feed which employs an alternative dispensation system to that previously shown.

Figure 8: a schematic and perspective representation of a cross shaped stirring bar which also functions as a plug which may be held in place by shaped groves in one embodiment of the invention.

Figure 9: a schematic crossectional representation of protrusions

present in the neck of the output from a food container.

Figure 10: a schematic and perspective representation of a slip fitting functional plug for food containing cone.

Figure 11: a crossectional representation of an embodiment of an appliance suitable for the preparation of baby feeds which employs an alternative means of initially heating the water.

Figure 12: a crossectional diagram of an embodiment of an appliance for baby feed preparation which employs liquid addition to an underlying container.

Figure 13: a schematic flow diagram describing appliance control functions.

Example 1

Figure 1 represents diagramatically an appliance for the bulk preparation of feeding milk. Referring to the drawing, the appliance comprises a head (1) with handle, which houses a food container, motor or motors, control electronics, indicators and electrical and mechanical coupling means. The appliance also comprises lid (2), liquid container (3) with handle, spout and which may or may not employ a condenser (4) and which also has a stirring mechanism. The appliance further comprises a heater/stirrer base plate (6) and a stand (7) which provides conduit for electrical connections and/or houses electronics, such

as temperature sensor (8) or other components, e.g. a fan.

Figure 2 represents schematically a cut-away view of a head assembly of the said appliance as viewed from underneath. This head assembly comprises an output hole (9) from the food container, an almost semi-circular in section channel (10) confining output hole (9), a couplage (11) to motor (12), food container (19), an area for control circuitry (24), a means for making electrical connections (15) to elsewhere in the appliance and an extended body (16) so shaped to locate on top of stand (7) and accommodate condenser (4) when in place on container (3) when the appliance is completely assembled.

The head assembly is designed so that all parts contacting baby foodstuffs are readily cleaned, disinfected or sterilised.

An important consideration for the manufacture of the said appliance/head assembly, etc., is that it should be constructed in material(s) readily moulded, shaped or otherwise formed which satisfy performance in use, e.g. temperature resistant, sterilisable, etc., as well as being inexpensive to mass produce. Some materials meet certain of these criteria such as glass and ceramics but several plastic materials may meet them all. Examples of such plastics are commonplace and commercially available in labware, e.g., from Azlon Products Ltd. for chemical/ biological

flasks, beakers, etc. Typical properties of some of these plastic formable materials relevant to the said invention are outlined in Table 1 below:

Table 1 Typical properties of some plastic materials.

Material	Polyethylene (High Density) (HDPE)	Polyproplylene (PP)	Polymethyl Pentene (PMP or TPX)	Teflon (P.T.F.E.)
Clarity	Translucent to Opaque	Translucent to Transparent	Transparent	Opaque
Rigidity at 2 mm Thickness	Fairly Rigid	Fairly Rigid	Fairly Rigid	Fairly Rigid
Max Use Temperature:				
Short Periods	120° C	140° C	200° C	300° C
Continuous	110° C	130° C	180° C	260° C
Sterilisation:				
Autoclave				
Dry Heat (160° C)	Yes	Yes	Yes	Yes
Chemical (eg Ethanol)	Yes	Yes	Yes	Yes
Resistance to Sodium Hyperchlorite	Good	Good	Good	Good

A high performance relatively inexpensive plastic such as polyethylene, even in its low density form, would be a suitable construction material for the head assembly. The exceptional properties of PMP would make this polymer a suitable material for the directly heated container, in this example shown by item (3) of Figure 1, if glass were not used. Polypropylene or PMP might be used for construction of the base unit and stand for example. Housed in the head is a motor used to drive the foodstuff metering mechanism. Mechanical couplage (11) may be attached directly to the motor drive shaft, alternatively the drive to the couplage may be off-set in order to accommodate other devices referred to later. Couplage (11) utilised, may be of a variety of designs, perhaps the best known being a cog. An important property of the said coupler/couplage is that it should be readily engaged into its mating part by a simple and convenient operation. By way of example only, a convenient means of simple and positive coupling may require couplage (11) to be constructed from a tough but partially flexible rubber. Such rubber-like cogs are well known to those skilled in the art and are regularly seen on commercially available food liquidisers for similar reasons. Couplage (11) may or may not have a central hole and or additional central bearing(s) to accommodate immersion devices as will be elaborated upon later.

The head may contain a second motor to drive an alternative type of stirring mechanism. Electrical power is required to energise control electronics, motor(s), sensor(s) and indicators so that a means of electrical couplage (15) is also present in head assembly (1) which mates with its counterpart in stand (7). Again an important property of this couplage is that it should be convenient to engage. Many types of simple plug and socket sets are known to those skilled in the art, examples are commonplace in many domestic appliances. A convenient location for electrical coupling is in the extended body (16) of the head assembly. Located on extended body (16) may, or may not, be a peg or post (17) of square crossection for example, which may be present for the purpose of fixing the head stationary when the appliance is in use and also for further guiding the engagement of the head to the other part of the appliance. Also found on the head is a broad channel (10) of almost semi-circular crossection and being concentric with the circumference of the mechanical couplage (10). The said crossection is designed for ease of cleaning by reducing sharp corners. The top of the channel is however flat, rather than rounded over a region defined by the dimensions of food container output (9). Surrounding output hole (9) resides a silicone rubber, or PTFE 'O' ring gasket (18) which conveniently fits into a recess around the hole. This latter arrangement provides a seal against

the vessel lid and is removable for cleaning purposes. The actual food container in the head is shown in Figure 2 by item (19) as viewed from underneath and in perspective. It is funnel-like in shape and has a smooth interior and provides a gravity fed foodstuff supply to the liquid below in this example. An alternative embodiment of the said funnel-like container may be a pre-weighed food cartridge. Very close to its apex and output hole, may be located sensors (20) such as the miniature photoswitches used in the food industry and manufactured by Omron Ltd., by way of example only. Other simpler sensor types well known to those skilled in the art of electronics and available from electronic components suppliers, as standard items such as LEDs and photodiodes may be used. Other electronic components, again readily available, which may be found in the head assembly include a buzzer (22) and indicator light (23) to signal when feed is made up. The buzzer mechanism (22) may be so positioned so that its vibration is coupled to food container (19) to shake out any traces of food at the end of the operation. The funnel-like shape of the food container (19) creates much space at the base of the head assembly which is conveniently used to compactly house motor(s) (12) and control electronics circuit board(s) (24) which in turn may also be boxed in and gasketed to provide a seal against water vapor. The food container will have a lid (not shown in Figure 2)

but stated as present. The extended portion of the assembly to its rear may additionally have moulded ribs (25) on some parts of its surface designed to facilitate air circulation around condenser (4) if force cooling to the condenser is provided by means of a fan, for example. The entire head assembly has an easy grip handle (26) on its top to facilitate quick, simple and positive engagement of the head assembly via self centering semi-circular like channel (10), mechanical and electrical couplages (11) and (15) respectively and additional fixing peg (17), if present. In an alternative embodiment of the proposed invention, the head assembly may also confine a means of quantifying the contents of the food container (19), for example purposes only, a weighing mechanism coupled to the said container and housed in the head assembly.

Figure 3 represents one method which according to the invention enables the dispensing of food from its container or cartridge (19) to the liquid below at a given time. This mechanism gives a periodic addition of foodstuff to the underlying liquid. The mechanism consists of a specially designed lid (2) the features of which will be detailed in what follows. The material of construction for lid (2) again may be selected from Table 1 for example purposes only and so need not be confined to such a selection. This specialised lid (2) is understood to be distinct

from the food container lid referred to earlier. The diameter of lid (2) is chosen to seal the liquid container below. Its principle features include an upward protruding almost semi-circular ridge (27) which serves for centering and guiding couplage to the head assembly (1) and is easily cleanable. One or more openings (28), gasket of otherwise, on the flat top part of the ridge (27) which mates with channel (10) in the head assembly. The size of hole (28) must be slightly smaller than that of hole (9) in the head assembly so as gasket (18) is properly seated always. Lid (2) may have an additional recessed gasket (29) running concentrically around fixed mechanical couplage (30). Couplage (30) is a rigid plastic fixed cylinder with teeth designed to mesh with flexible cog (11) in head assembly (1). There may, or may not be depending on the design, an additional axial hole (31) through the lid (2) to accommodate immersion type devices such as heaters, temperature sensors, stirring paddles, etc. which may be used in different embodiments of the proposed invention. Ridge (27) may or may not be concave, a concave version is shown, by way of example only in Figure 3, together with drip collectors (32) upwardly curved smooth under surfaces (33) and central drip collector (34) which may be partially absent if axial hole (31) is present. To aid rotation of the lid between the head assembly (1) and the liquid container (3), lid (2) may have inlaid in its upper

and lower surfaces low frictional materials such as PTFE, if the said lid is not indeed constructed from or already coated with PTFE. A simpler aid to rotation is provided by way of bearings/ rollers/ wheels (35) situated on the periphery of lid (2) with their axes in a plane parallel to lid diameters. Another feature of lid (2) is the notch block (36) which contains notch (37). The notch block is located in one position only on the lid (2) edge at a position as far as possible from opening (28), or equidistant from such openings if two such opening are present, for example. The function of block (36) is to permit lid (2) to be located onto vessel (3), or alteratively head assembly (1), in one configuration only and in such a way that the output from food container (19) is always closed at the start of the feed preparation cycle. Notch block (36) need not be very big, say 1-2 cms in length, and engages into a mating gap in a guide rim in the underlying vessel, or the overlying head assembly. Notch (37) itself is semicircular in section to facilitate cleaning and loosely fits a corresponding shaped rim in the vessel below, or alternatively on the head above, as will be described later. The notch block may also have an index mark painted/ scribed/ moulded, etc. on its surface which corresponds to a similar mark, distant from the food container output hole (9) and a mark on the vessel or head corresponding to the position of the rim gap. The index marks are to convenience

the end user/ operator.

Rotatable lid (2) is in fact a form of shutter and is meant as an example of a means whereby foodstuff can be periodically dispensed. Other types of shutter for performing the same function but which do not rely on rotation are not excluded in the proposed invention. The electrically activated shutters found in reflex cameras for example could form a suitable alternative to (2) in different embodiments of the invention, if they are made to oscillate at suitable frequency/frequencies. The said alternative type shutters alluded to may offer design advantages and may use static lids for vessel (3).

With regard to the alternative embodiment of the proposed invention which engages notch block (36) into the head assembly with a suitable modification to provide a rim with gap thereon, an advantage of easier assembly from the operators standpoint is perceived in addition to simpler vessel (3) design particularly if glass-like materials are used in the said vessel construction.

Figure 4 represents, in a schematic way, liquid container (3) which has a handle (38), broad spout (39) and graduation markings (40). The vessel need not be transparent, but this is preferable for visual check of correct operation. Glass or PMP are choice

materials for the construction of vessel (3). As before vessel (3) should be readily sterilized/ cleaned, etc. and must be able to withstand exposure to boiling water. The dimensions of the vessel are design parameters which influence the rate at which boiled parameter which can cool under ambient conditions. The volume of liquid held will be variable according to what is defined as 'bulk' earlier. Graduations (40) may not correspond to absolute volumes, but will ultimately correspond to set numbers of feeds. The volumes marked may initially be slightly larger than what is actually required to compensate more precisely for evaporation losses. Spout (29) is broad to facilitate filling and pouring and may have a special joint (41) to engage in condenser (4). This joint may be of the bayonet, threaded or simply ground glass type for example - the latter type being commonplace in laboratory glassware as manufactured by Quick*Fit Ltd. The said condenser (4) may be constructed from a dissimilar material from vessel (3) if required to ensure that joints never jam. For convenience, condenser (4) is cooled, although liquid cooled versions are not excluded. The design of condensor (4) bears closer resemblance to a laboratory distillation column such as the common Vigreux, Pear bulb or Dufton types, to improve its efficiency. Circulation air, heat pumping or sinking may also be used in the appliance to improve the efficiency of the condenser if necessary. The

condenser length may protrude above the height of the appliance when assembled and may have a plastic mesh covering on its top end. Other features of vessel (3) may include the semicircular rim guide (42) to engage notch (37) in lid (3), and rim guide gap (43) to engage notch block (36) in lid (3), as earlier alluded to. In an alternative embodiment rim guide, gap etc. are part of the head assembly. Another feature of vessel (3) is its center post (44) located on the vessel base. The said post performs a special function described later. Another feature of vessel (3) is a three rigid sided protruding enclosure (60) located beneath the spout. A fourth side in the form of a split flexible rubber curtain may, or may not, also be in place in on enclosure (60). The enclosure (60) is a draught excluder protecting a thermal sensor to be described later, but which may in one embodiment of the proposed invention, protrude from the supporting stand (7).

Figure 5, represents in crossection and schematically, the way in which a magnetic stirring bar, may be located, on a semi-permanent basis, in vessel (3) so it will not be inadvertently forgotten, a situation which would not facilitate mixing. The post (44) need not be present at all or in the form shown, by way of example only, but it is a design feature meant as a safeguard for proper mixing. When vessel (3) is made from a plastic, post (44) can be moulded

in at the design stage. Inclusion of post (44) in glass is also possible, though less straightforward and for glass construction of vessel (3) it is preferred that a simple threaded hole, perhaps counterbored from the liquid side is provided. In this case a glass or plastic internally threaded post, perhaps seated on an 'O' ring can be erected and fastened from below with a metal screw, still leaving thread for plastic or plastic covered cheeshead screw (46). Again, in plastic construction, center hole (45) is tapped all the way through post and vessel base. Tapping all the way through rather than into a 'blind hole' (one still blocked at one end) is simpler from a tooling perspective, if tooling is required. A hole though the base also serves as a safeguard to an extent, since the filling of vessel (3) is impossible unless cheeshead screw (with or without 'O' ring)(46) is in place. The placement of screw (46) serves to fix the location of magnetic stirring bar (47) and whilst placement of screw (46) into hole (45) does not guarantee that magnetic stirring bar(47) is present, it does nevertheless serve as a strong reminder. Notwithstanding the latter part of the discussion above which also indicates the simplicity of stirrer detachment for cleaning purposes, stirrer bar (47) is deliberately loose fitting on post (44) (which may be tapered). This arrangement means that it is unnecessary to detach the stirrer for cleaning purposes, every time the appliance is

used. The loose fitting arrangement results from diameter 'c' being greater than internal diameter 'b', which is in turn greater than post top external diameter 'a' with reference to the drawing in Figure 5.

Stirring bar(s) (47) is glass or PTFE encapsulated magnetic bar(s) for example with a hole in its center which is oversized with respect to its fixing post (44). All parts of the bar which contact baby feed are encapsulated with glass or PTFE, for example, the latter being an inert, sterilisable heat resistant polymer. Such stirring bars are conventionally used in laboratories and simple versions are available form laboratory suppliers such as Gallenkamp Ltd. They may have holes or slots to produce vortexing or turbo effects and represent efficient and familiar stirring mechanisms. If necessary additional baffles may be inserted into vessel (3) to further facilitate stirring. In another simpler embodiment of vessel (3), no post nor hole are present at all and a conventional encapsulated bar is simply added. This embodiment has the advantage of extra simplicity, but the disadvantage in that the bar may be forgotten to be added or may be mislaid.

Figure 6 represents a perspective schematic view of the base unit which features a heater/stirrer plate (6) with or without slots,

upright stand (7) with electrical contacts/sockets (48) to mate with couplages (15) from head assembly (1), and an appropriately shaped hole/socket (49) to mate with peg (17) of head assembly. Other features in brief include indicator light (50) in base body (51), on/off switch (52), output socket (53) (optional) electrical mains connector socket (54), vents for stand condenser fan (55) and the particularly important temperature sensor (8) for example of a spring loaded contact type mounted on a protrusion from stand (7) and designed to mate into draught excluder housing (60) on liquid vessel (3). This sensor detects the onset of the optimum temperature range for milk mixing and is hence tunable to that range. It makes intimate contact to vessel (3) by spring loading. In more detail stand (7) provides a conduit for electrical connections and/or a housing for circuitry and an optional fan which would be situated near the ultimate position of the air condenser (4) in the assembled appliance. Stand (7) also enables positioning of important thermal sensor (8). The base body (51) houses a conventional heater/stirrer similar to those used in laboratories and manufactured by companies such a Gallenkamp, Bibby, Stuart all of UK, Corning (FR), IKA (FRG) for example. The stirring action in these commerical appliances is provided by a motor which rotates a metal bar in a plane perpendicular to it's drive shaft and parallel to the overlying plate, the latter being coupled with a remote coated magnetic bar which is present above (eg within a vessel).

The base body may additionally house a cooling fan for upward forced cooling to a specific temperature range only. In the latter case heating/stirring platform (6) may be slotted. The said platform slotted or otherwise

may be formed from metal or ceramic. The electrical power rating of the heater need not be high as in laboratory equivalents, since exclusively water or sterilizing solutions, are the only liquids to be boiled (b.p. 100°C). Located in the heater unit will be a thermal sensor to provide automatic cut-out to the heater only when boiling has occurred. On/off switch (52) energises the entire unit and powers indicator light (50). The function of the optional output socket (53) is to activate external devices such as automatic feeding bottle sterilisers at given times as will be described more fully later.

In another embodiment of the proposed invention the thermal sensor, for detecting the onset of the optimum mixing temperature range (cf item (8) Fig 1), may be of the immersion type which protrudes into the stirring liquid and is coupled by appropriate bearings and electronics through axial hole (31) in lid (2) and through the couplage (11) of the head assembly (1) where its control circuity lies. In this arrangement the immersion temperature sensor is electrically connected via appropriate socket connectors to allow for dismantlement and cleaning.

The mode of operation of the proposed appliance will now be

described in detail with reference to the foregoing description. As far as the operator is concerned the appliance need only be charged with the appropriate volume of cold water assembled and charged with the appropriate volume of milk powder/granules and then switched on. The appliance automatically controls all other functions including signalling to the operator when the bulk feed is ready.

The mechanism of operation is described in what follows. Switch (52) when 'on' powers the entire appliance. The heating/stirring commences bringing water in vessel (3) to the boil at which point heating only is deactivated under command from a hot plate thermal sensor or other means. When the heater is energised both the fan in the base body (if present) as well as optimum temperature range sensor (8) (immersion or contact types) are not activated. The fan, if present, in stand (7) to force cool condenser is, however, activated. These procedures are readily controlled by electronic logic circuitry well known to those skilled in the art of electronics/electrical engineering, for example. The deactivation of the heater may be used to provide a signal to output socket (53) to now activate some external device such as an automatic feeding bottle steriliser. Deactivation of heater in the base unit may also be used to now activate base unit fan, if present, and the

important optimum temperature sensor (8). Nothing further happens with the appliance at this point (other than the continuous stirring of the liquid). On sensing the onset of the optimum temperature range best suited for particulate milk addition several events happen simultaneously. The fan in base unit, if present, is now deactivated, sensors (20) on the food compartment become active and head motor (12) is energised. Activation of motor (12) causes lid (2) to rotate and dispense foodstuff to the stirred liquid below at the correct temperature range best suited for mixing. Hole (9) size, the upper weight limit of a food charge, rotational speed of lid (2) and the number of holes (28) present in lid (2) are design parameters which can be optimised to cause maximum rate dispensing into a vessel (3) with specific dimensions, thermal characteristics, etc, so that foodstuff addition is complete whilst within the optimum mixing temperature range. Complete, or essentially complete discharge of food container (19) is detected by the sensors (20) which in turn trigger a control circuit, which energises buzzer (22) (with food container shaking action) and indicator light (23) signifying feedstock is ready and also deactivates motor (12), as well as the motor in the base unit which has maintained stirring throughout and also the stand condenser fan if present.

=> you make not how are bottles each.

The bulk volume of baby feeding milk may then be transferred to sterile bottles (prepared freshly during the milk preparation under command from the proposed appliance, or otherwise prepared) and used or cold stored.

The sterilizing cycle for the proposed invention is very similar to the food preparation cycle. After feed preparation, vessel (3) complete with stirred bar (47) in place, is rinsed in cold water, the vessel refilled and the appliance reassembled as before. In place of foodstuff, an appropriate quantity of sterilizing solution for vessel (3) volume, is changed into food container. Mains switch (52) and a second switch (56) marked 'sterilise/rinse' are simultaneously switched on. The cycle proceeds as before except the action of switch (56) overrides the commands of optimum temperature sensor (8) and deactivates sensors (20). On a signal from the thermal cut out when boiling has occurred, the control logic circuit for sterilizing engaged by switch (56) now activates motor (12) so solution from the food compartment (19) is dispensed in a way which contacts the entire food path of the previous cycle so cleanliness is ensured. A timer in the sterilizing circuit enables power to be cut off to the entire appliance after a nominal waiting period. A third rinsing cycle may be performed in the same way if desired without sterilizing solution and using switch (56).

The modular and simple construction of the entire apparatus means whole parts, lid (2), stirrer (47) and vessel (3) with or without post (44) and screw (46) can be occasionally completely sterilised by other procedures if desired. Simple electronic components and conventional logic circuits are used in the appliance which are easily constructed in compact PCB form and are well known to those skilled in the art of electronics, for example. The necessary electrical components are all standard items from large component suppliers such as Radio Spares Ltd., U.K.

Example 2

In this example several features already described in Example 1 are common, but the means of dispensation of the foodstuff differs. Head (66) forms both cover/lid as well as housing conical food container (65), which in this embodiment of the appliance, is now centralised in the head as indicated by the crossectional drawing in Figure 7. The orifice of the food container is plugged to allow filling of the food hopper. The said orifice is of a specific diameter designed to enable gradual emptying of the hopper. Unplugging of the hopper to allow passage of foodstuff to the underlying receptacle is achieved under command from thermal sensor (63) which detects the optimum temperature for food mixing, the importance of which has already been explained.

The operation of this embodiment of the appliance for the preparation of baby food will now be described in more detail in what follows:

Water in receptacle (61) is brought to the boil under the action of base plate heater (62). After boiling, the heater is deactivated and nothing further happens until the boiled water cools and the sensor (63) detects the correct temperature for food addition. At this point sensor (63) activates vibrator (64) located near the base of food containing cone (65) in head (66) which provides a shaking loose of cone plug (67) and simultaneously facilitates total discharge of the foodstuff into the underlying liquid now at the correct temperature for mixing. Judicious design of the plug and the neck of the cone at its orifice are important to ensure reliable unplugging on demand from temperature sensor (63).

In one variation of the appliance using this type of dispensing mechanism, the magnetic stirring mechanism is identical to that described in Example 1, ie, a stirring bar (68) is located on a tapered centre pivot. In this case the appropriate plug is of a passive type and may be constructed from a low density plastic so that when it is discharged from the orifice it may float on the liquid below and be subsequently recovered. Alternatively it may be linked via tether (69) to the underside of the head in such a

way as to prevent its total detachment from head but nevertheless allow opening of the food hopper.

In a still further alternative variation of the appliance exploiting this type of dispensing system, the plug is functional in that it serves more than one purpose. In this case it may be constructed from an inert plastic coated magnet. The receptacle for this design then need not contain a central tapered pivot post, since when the functional plug is released, it falls into the liquid below, sinks and simultaneously provides agitation by following the rotation of the remote stirring control mechanism (70) located in the base of the appliance. In this way inadvertent addition of the magnetic stirring bar is circumvented since the food container cannot be shut off unless the functional plug is in place. This feature further simplifies the design of receptacle (61), particularly if constructed in glass, by obviating the need for the pivot.

In order to maintain the plug in place on a temporary basis (ie until the correct mixing temperature is reached), the plug and the cone neck have particular design features which will now be described. Particular design features are necessary because of the requisite cleanliness of the apparatus.

In a preferred embodiment for hopper plug, smooth quarter turn accutely angled protrusions are moulded in the cone neck which mesh with smooth matching grooves in the plug. By way of example only, the functional plug is designed to be symmetrical so that it cannot be incorrectly located into food cone neck. To provide efficient stirring and to minimise the stirring bar from running out of synchronization with the remote control drive mechanism, a cross shape may be utilised as illustrated schematically in Figure 8. The said grooves in the stirring bar are indicated by items (71) in Figure 8 and run in the opposite direction on the reverse side of the bars. The crossectional shape of any arm of the cross matches that of food cone orifice. Alternatively any two opposite arms may be grooved whilst the remaining two arms may be made different so that it will be obvious that they cannot plug the orifice (eg, their diameters may be oversized with respect to the orifice).

In the case of the passive (non magnetic) plug, similar grooves may be present.

With regard to neck design of the food container, gently smoothed

protrusions are moulded into the neck to match the grooves in the stirring bar. Tolerance in grooves and protrusions are very low since only a loose fitting is required. The location of the said protrusions (72) in the neck of the food cone are indicated schematically in Figure 9.

An alternative embodiment for plugging the cone on a temporary basis employes a simple slip fit plug with no protrusions or grooves. Maximum plug insertion distance in this case is controlled by way of ridge(s) (73) at a specified distance from plug end(s) as shown by way of example in a schematic representation of a functional plug design in Figure 10.

In a still further embodiment utilising the vibration driven dispensing system in this example, the output from the food cone may itself be flexible/rubberlike or it may be connected by a short length of flexible tubing which may be mechanically constricted under primed spring action to effect closure of the food hopper until opening is required. This alternative design obviates the need for a discrete plug. On sensing the correct temperature for food addition in the appliance using this design, thermal sensor (63) in Figure 7 enables vibrator (64) to start food shaking as before, but also the vibration releases a spring so that the

flexible tube now opens. Agitation in this embodiment of the appliance is provided by a means already alluded to, eg in Example 1.

Example 3

Certain features described in Examples 1 and 2 may be common to this third example of an appliance suitable for the preparation of baby feeds. To facilitate clarity of description, the dispensation system featured in Example 2 is also utilised herein, but it is understood that this is in no way meant as a limitation in the present system. A distinctly different feature in the present example relates to the liquid supply for the feedstuff, the way in which it is boiled and its initial location. In the present example, the initial water supply is located in reservoir (74) in the upright stand of the appliance as illustrated by the crossectional schematic Figure 11. Thus receptacle (75) which ultimately will contain the feedstock starts off empty. Whereas simple, well established principles for providing a means of heating such as a hot plate were employed in the embodiments described in Examples 1 and 2, a further, alternative yet also well established means of heating and liquid transfer is employed in this Example. Thus the bringing of small quantities of water to

the boil at a time by heater (78) and then allowing it to rise under the force of its own vapor pressure up a riser tube (76), is used as a convenient method already known to those skilled in the art and already present in domestic appliances such as percolators. The output from riser tube (76) issues water in a heated state (now cooled from 100°C, typically to about 80°C) directly into empty receptacle (75) where it is collected and allowed to further cool. The correct volume of previously boiled water to be collected in receptacle (75) is sensed by an electrical level indicator (77) positioned near the bottom of supply reservoir (74). The appliance is so designed that irrespective of the required quantity of liquid feed, the temperature of the collected water is always greater than that of the optimum temperature for food addition to give the correct quality of feed. Additionally it will remain higher than that temperature until the entire volume of water desired has passed over. When this situation arises as sensed by level indicator (77) a number of events occur, viz: power to heating element (78) is cut-off preventing further heating; thermal sensor (79) for detecting optimum mixing temperature/temperature range is activated; a fan which may be located in the upright stand directed towards receptacle (75) is, if present, activated. Nothing further occurs until the water is at the correct temperature for food addition, a situation that is sensed only on the cooling cycle as

the previously boiled water loses heat. As with the aforementioned Examples, the signal from thermal sensor such as (79) is used to activate a dispensing system of the types already alluded to for example.

This design has the advantage that the receptacle which ultimately holds the feedstuff need never be subjected to direct heating in order to boil water. When the receptacle collects water, only a cooling action is required. Thus there is no need for a heated base plate for example and the receptacle may rest on a simple plastic platform (81). This base platform contains the remote stirring control motor (82) as before and may also now contain the thermal sensor (79) for optimum temperature of mixing sensing since no heater now underlies the receptacle. The choices of plastic materials for constructing both receptacle and base platform are less restricted as a result of reduced upper operating temperature limits. Another result of reduced upper operating temperature limits means that a condenser (as used in Example 1), is unnecessary to minimise evaporation losses. A readily sterilisable inexpensive plastic would be the preferred construction material for receptacle (75) preferably with receptacle handle and centre tapered pivot all mounded in one operation during manufacture.

As in the other examples, electrical connections to components involved in the dispensing system may be suitably fed through appropriate spaces in the upright stands common in all of the different embodiments of the appliance for the preparation of baby feeds and control electronics may be located in part of the upright and/or head. Complete detachment of the head as in Example 1 is now not always necessary. In Examples 2 and 3, the part containing the food cone may be swung out of the head on a hinge, and so permanent electrical connections can easily be maintained.

Example 4

In this example some of the features common to the other examples are also present. The major difference in the embodiment described in this example relates to the way in which previously boiled water, cooled to an optimum temperature for mixing, is brought into contact with the particulate foodstuff. In the present case water in the aforementioned condition is added to the foodstuff rather than the foodstuff being dispensed into the thermally optimised sterilised water as in the previous examples. The advantage in the present case relates to the more facile procedures available for liquid dispensation as opposed to solid dispensation, furthermore cleanliness considerations are much less complex since moving parts

can be used which cannot now be jammed/clogged, etc. nor can solids be built up in crevices, grooves etc., when liquids are dispensed. Furthermore, immersion devices, eg heaters can be employed directly to heat water to boiling quickly and efficiently in a vessel which will itself not ultimately contain the feed. The design of the appliance in this example is essentially an inverted version of what has been described before. This design is perfectly functional as experiments clearly demonstrate that when water at the correct temperature is added even slowly (trickle, for example) to large masses of dry particulate foodstuff, correctly made up feedstuff results provided efficient mixing is employed. The mode of operation of this embodiment of the appliance will now be described by way of example only and with reference to Figure 12. The appliance works by charging the empty underlying vessel (84) with the requisite quantity of dry particulate food, a means of stirring this vessel such as a magnetic stirring bar (85) for example purposes only, is already in place before food addition. The food charged vessel then sits on base/platform (86) which has no heating function. The appropriate volume of water for the food charge is loaded into uppermost vessel (87), which as indicated in Figure 12 is a permanent part of the appliance, in other variants however this may also be removable. Vessel (87) may be moulded from resin types commonly exploited in modern kettle designs as the

temperature resistive criteria are the same. Many plastics can additionally be chemically sterilised as already discussed (cf Table 1 for example). Vessel (87) contains and electric kettle type immersion heating element (88) located near the bottom to allow for minimum volume heating (say one 250ml bottle for example). The base of vessel (87) is so shaped to allow complete drainage when required. Located at an exit to vessel (87) is an electrically controlled valve (89) such as the commonplace solenoid type valves. Vessel (87) may also contain a paddle stirrer (90) to uniformly distribute heat. Located near the base of vessel (87) lies thermal sensor (91) for sensing the optimum temperature for mixing to achieve a correctly made feed. Conduit (92) carries electrical connections from sensor (91) and valve (89) into the appliance upright stand (93) where control electronics may be located. The said upright stand may additionally have vent (94) and fan (95) judiciously placed to provided forced cooling (after water boiling) to vessel (87) if so desired, in which case fan (95) would only be active following the cut-off of heat supply by element (88) and would be deactivated by a signal from sensor (91). Vessel (87) is covered by lid (96) which may be vented, alternatively vessel (87) may have a spout or the like which remains open to prevent pressure build up. Vessel (87) may have a float type level indicator to signal to the user the appropriate

volume present and may have a ribbed exterior to increase surface area and facilitate fast cooling. It may also be additionally coloured to allow fast radiative dispersion of heat, black would be an appropriate choice. On energising the appliance with mains power via on/off switch (97), water in vessel (87) is brought to the boil and the heat is then cut-off. Nothing further happens until the sensor (91) which monitors the condition of the now cooling liquid detects the temperature for mixing the foodstuff and the previously boiled water together. When this occurs solenoid valve (89) is activated and vessel (87) drains under gravity and at a rate controlled also by the outlet diameter (and in either a continuous or discontinuous fashion) into the powder loaded vessel (84) below. The cooling of liquid in vessel (87) to the optimum temperature may be augmented by means of a fan as alluded to above. As in all the other cases, the circuity in the appliance functions in such a way that the sub 100°C optimum temperature required for mixing is only sensed on the cooling cycle, ie, it is not sensed as the water is brought to the boil. Stirring mechanism (85) may be engaged from the very start of the procedure, ie, it may be activated by on/off switch (97), alternatively it may become active on signal from sensor (91). A timer circuit may also be present to allow stirring to continue for a set time after food addition (which will be sufficient to ensure complete mixing) before an

indicator such as a buzzer or light or both (98), signals the user that the feed is complete.

Design of base platform (86) is such to ensure stability to the appliance, which will be temporarily top heavy at the boiling/cooling sequence part of its operation. Base platform (86) also houses the remote control for magnetic stirring action or motor(s) and couplages for fixed alternative stirring embodiments, for example similar to those found in common domestic appliances such as liquidiers and food processors, for example. Located in the base plate, and for the convenience for the user, may be a further switch (99) which on depression when the appliance is powered up allows the previously described sensor (91)/valve (89) interaction to be overridden so that the valve can work independently, a situation which may be useful in the event that the user has inadvertently overfilled vessel (87) and wishes to conveniently adjust the water level before placing vessel (84) in its proper location.

Additional functions such as detailed in Example 1 pertaining to sterilising cycle for cleaning after food preparation and triggering external devices such as bottle sterilisers, etc. may

also be featured in this and the other designs of an appliance for the preparation of baby feeds.

The gravity feeding of water to the feedstuff as described in Example 4 is but one means of achieving liquid addition to the solid. Other means using siphons, accumulated vapor pressure to cause properly thermally conditioned liquid transfer, etc., etc. are not excluded but offer no advantages over the simple embodiment detailed above.

Example 5

In the foregoing examples, a common feature essential to the correct function of the appliance for baby feed preparation is the sensing/dispenser activating system. The thermal sensor for the detection of the optimum temperature for the mixing of foodstuff and previously boiled water must only sense the said temperature as the water cools from its boiled condition, thus it must ignore this temperature on the heating cycle wherein the water is first raised to the boil from, for example, an ambient temperature. In this way, the traditional well tried and tested manual method for conditioning water suitable for baby feed preparation is closely simulated.

In order to control the appliance and to sense the optimum temperature and activate a dispensing system (for liquids or solids) for the purpose of providing the first correct opportunity to mix previously boiled water and foodstuff, an example of a typical control system, depicted schematically by the flow diagram shown in Figure 13, is provided but is not meant to be limiting in any sense with regard to the invention.

The way in which the said exemplary control circuit functions is briefly described in what follows with reference to Figure 13.

In this example some basic function of appliance control are given by way of example. Control circuitry suited to the invention may incorporate analogue and/or digital electronics in design using techniques known to those skilled in the art. In an analogue design, positive feedback switching may be incorporated to enable the part of the circuitry used to control a dispensing system which will be implemented on the cooling cycle as the previously boiled water loses heat. The dispensing system may be activated by transistorized switching, for example.

The circuitry which controls the dispensing system may be

implemented using voltage comparators which compare the voltage returned by the temperature sensor (used to detect the onset of the optimum condition for mixing foodstuff and previously boiled water) circuit with a given set point voltage.

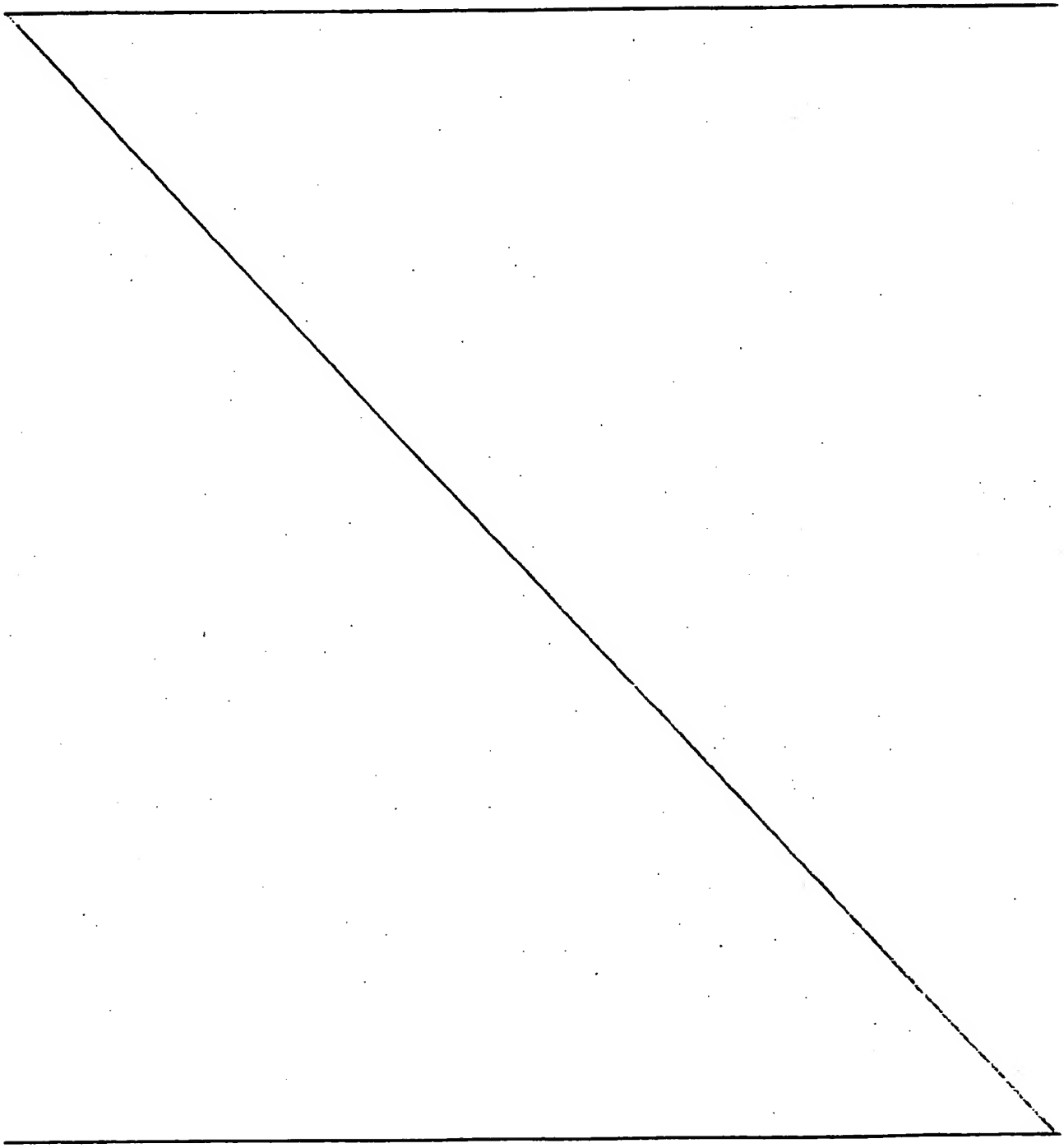
The temperature sensing mechanism may comprise of a thermistor in series with a resistor which forms a potential divider for the purpose of providing an input for other control circuits.

Typical control functions for the appliance are described by way of example only, with reference to the flow diagram shown in Figure 13 in which the various sub-units are itemised thus: (100) heating element, (101) water supply, (102) temperature sensor, (103) master control circuit, (104) mains power switching device for heating element, (105) status indicator(s), (106) mains power switching device for stirrer motor, (107) time delay, (108) dispensing mechanism and (109) stirrer motor control.

Switching device (104) cuts off mains power supply to heating element (100) when the water supply (101) has been brought to the boil, or has been boiled for a given time. Switching device (104) may use, for example, triac or relay based circuits activated from signal(s) from temperature sensor (102), which for example may be

a thermistor. Dispensing mechanism (108) may be of a variety of types depending on the particular embodiment of the appliance and so it may implement a variety of electrical components such as motor(s), vibrator(s) or solenoid devices, etc. The dispensing mechanism may or, may not, be activated at the same time as stirring motor control (109), alternatively the stirring motor control may be implemented after a delay time controlled by optional time delay circuit (107). This may be desirable, for example, in an embodiment in which liquid is added to solid, whence stirring may be activated when a particular volume of liquid has been added. Timing functions may be implemented using methods well known to those skilled in the art, by, for example RC circuits or using integrated circuits such as chip 555IC available from Texas Instruments (USA) and other manufacturers. Activation of the stirring motor control circuit (109) on receiving a signal from master control circuit (103) may be effected through mains switching device (106). Alternatively and more simply, switching device (106) may not be present in which case the stirring motor circuit (109) is activated at appliance power up. An optional part of appliance control and monitoring may further implement status indicators (105) and associated circuitry. Master control circuit (103) will have in-built a means for overriding the optimum temperature in the heating cycle as water is brought to the boil

but for sensing the said optimum temperature, used to activate a dispensing system, on the cooling cycle as the previously boiled water loses heat.



Claims

I. An appliance for the preparation of baby feed from particulate forms of foodstuff which comprises:
a container for the particulate foodstuff,
a container for water,
means for heating the water to boiling,
a sensor for detecting the water temperature,
a dispensing system for bringing the particulate foodstuff and the water together in one container,
means responsive to the temperature sensor for activating the dispensing system on the cooling cycle only when previously boiled water cools to an optimum temperature or temperature range for mixing the particulate foodstuff and the water,
and means for agitating the mixed particulate foodstuff and water to produce the baby feed.

2. An appliance according to Claim I in which previously boiled water is dispensed into a container charged with particulate foodstuff when the water has cooled to an optimum temperature or temperature range for mixing the foodstuff and the water together.

3. An appliance according to Claim I in which particulate foodstuff is dispensed into a container charged with water which has been firstly boiled then cooled to an optimum temperature or temperature range for mixing the foodstuff and the water together.

4. An appliance according to Claims I and 3 in which water is boiled then cooled in the same container that ultimately contains fully prepared baby feed.

5. An appliance according to any of Claims I-3 in which water is first boiled in a separate container then transferred to the container that ultimately contains fully prepared baby feed.

6. An appliance according to any of Claims I-5 in which a dispensing system provides the opening of at least one pathway between containers for water and particulate foodstuff in response to a signal from a temperature sensor.

7. An appliance according to Claim 3 which employs a rotating lid with openings suited to the periodic dispensation of a particulate foodstuff to water at the optimum temperature or temperature range for mixing.

8. An appliance according to Claim 3 which employs a means of providing vibration to dislodge a plug for a food container.

9. An appliance according to Claim 8 which employs the coupling of vibration to a food container as a means of shaking foodstuff from the said container.

I0. An appliance according to Claim 2 which employs a valve operated by the temperature sensor as part of a dispensing system for bringing water and particulate foodstuff together in one container.

II. An appliance according to any of Claims I-I0 which has an electrical output socket for the purpose of communicating to other external automated appliances.

I2. An appliance according to any of Claims I-II which employs a means of force cooling in order to reduce the wait period as boiled water cools to an optimum temperature or temperature range for mixing with particulate foodstuff.

I3. An appliance according to any of Claims I-I2 which employs a magnetic stirring bar and a driving mechanism for same.

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